

# PATENT SPECIFICATION

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## (54) SANITARY ARTICLES FOR ABSORBING BODILY FLUIDS

(71) We, KAO SOAP COMPANY LIMITED, of 1,1-chome, Nihonbashi-Kayabacho, Chuo-ku, Tokyo 103, Japan, a Japanese Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed to be particularly described in and by the following statement:—

The present invention relates to sanitary articles for absorbing bodily fluids containing an absorbent material comprising (a) a salt of an acrylic acid polymer and (b) at least one substance selected from guar gum, alginates and xanthan gum.

It is known that when an acrylic acid-type polymer contacts an aqueous liquid, it absorbs a large amount of the liquid and swells, forming a gel. However, although acrylic acid polymers can absorb considerable amounts of pure water, they can absorb only small quantities of aqueous electrolyte solutions.

We have discovered that an excellent aqueous liquid absorbing effect can be obtained, regardless of the presence of electrolyte in the liquid, when the absorbent composition comprises (a) a salt of an acrylic acid polymer in combination with (b) at least one substance selected from guar gum, alginates and xanthan gum. Moreover, if polyvalent ions of a metal such as calcium, iron, aluminium or the like are incorporated into this absorbing material, the absorbency is further improved. When this absorbent material is utilized in a disposable nappy or feminine sanitary towel, even in the case of unexpectedly large amounts of discharges or even if a relatively high pressure is applied to the composition while it is used, leakage of the liquid from the absorbent material scarcely occurs and clothing or the like is not stained at all. Accordingly, sanitary articles possessing excellent absorbency properties can be obtained when the absorbing composition specified in this invention is used in them.

Examples of suitable acrylic acid polymer salts (a) are salts of linear polyacrylic acids, salts of branched polyacrylic acids, salts of partially hydrolyzed polyacrylamides, salts of partially saponified polyacrylic acid esters and salts of graft copolymers of acrylic acid with cellulose, starch or the like. As the acrylic acid salts, there can be mentioned alkali metal salts such as sodium and potassium salts and ammonium salts.

The salts of polyacrylic acids to be used in this invention preferably have a molecular weight of 10,000 to 10,000,000. The salts of partially hydrolyzed polyacrylamides preferably have 5 to 50% of the amide units hydrolysed.

The salts of partially saponified polyacrylic acid esters preferably have 50% to 100% of the ester units hydrolysed.

The component (b) is selected from alginates, xanthan gum which is produced by *Xanthomonas campestris* (and which is composed mainly of D-glucose, D-mannose and D-glucuronic acid and is considered to have a molecular weight of at least 10<sup>6</sup>) and guar gums such as those obtained from albumen fractions of seeds of leguminous plants (which are considered to be composed mainly of galactomannan and have a molecular weight of about 200,000 to 300,000). Two or more of these substances can be used in the form of a mixture.

The alginate may, for example, be an alkali metal salt or an alkaline earth metal salt or a mixture thereof.

In the present invention, it is preferred that the weight ratio of component (a): component (b) be in the range of from 5:95 to 95:5, especially from 30:70 to 70:30.

The amount of the mixture of the component (a) and (b) incorporated in a sanitary article, such as a disposable nappy or a feminine sanitary towel, is preferably

from 0.1 to 5.0 g. In the present invention, germicides and the like can be incorporated into the absorbing material, if desired.

The present invention will now be further described in detail by reference to the following illustrative examples Nos. 2, 3, 4, 6 and 8. Examples 1, 5 and 7, illustrate the absorbency of absorbent compositions suitable for use in the invention.

#### Example 1

5 g of a mixture of a sodium salt of a partially hydrolyzed starch-acrylamide copolymer (hereinafter referred to as "Na-SAA") and sodium alginate were sealed in a non-woven fabric 5 cm×10 cm in size, and the sample was immersed for 10 minutes in 500 ml of a simulated urine composition (containing by weight 2.0% of urea, 1% of NaCl, 0.1% of CaCl<sub>2</sub>, 0.1% of MgCl<sub>2</sub>, and the balance deionized water) and then the sample was maintained in air at room temperature for 30 minutes and the amount of liquid absorbed was measured. Further, the amount of liquid absorbed was measured after a load of 45 g/cm<sup>2</sup> had been imposed on the sample for 3 minutes. The results obtained are shown in Table 1.

TABLE 1

| Run No.    | Na-SAA (wt.%)            | Sodium Alginate (wt.%) | Amount (ml) of Absorbed Liquid under Load of 0 g/cm <sup>2</sup> | Amount (ml) of Absorbed Liquid under Load of 45 g/cm <sup>2</sup> |
|------------|--------------------------|------------------------|--|---|
| 1          | 100                      | 0                      | 43   | 22  |
| 2          | 70                       | 30                     | 75   | 58  |
| 3          | 50                       | 50                     | 82   | 65  |
| 4          | 30                       | 70                     | 83   | 54  |
| 5          | 0                        | 100                    | 60   | 45  |
| comparison | 10 sheets of crepe paper |                        | 35   | 13  |

#### Example 2

Horse blood was dropped at a rate of 10 ml per minute from a pipette having an orifice diameter of 2 mm onto the central portion of a feminine sanitary towel containing a sodium salt of a polybranched polyacrylic acid (Na-PAA) and potassium-calcium alginate (the K:Ca cation ratio being 4:1) and also onto a conventional feminine sanitary towel having the same weight and form as the one employed above but not containing the composition according to the invention. The total amount of the blood that has been dropped was measured when the sanitary towel was saturated with the blood. The results shown in Table 2 were obtained.

TABLE 2

|   | Convention Feminine Towel (6.0 g)   | Feminine Towel (6.0 g) Present invention   |
|---|---|--|
| Materials   | 5.0 g of absorbent paper, 0.5 g. of waterproof paper, and 0.5 g of non-woven fabric | 4.0 g of absorbent paper, 0.3 g of polybranched Na-PAA, 0.7 g of K-Ca alginate, 0.5 g of waterproof paper, and 0.5 g of non-woven fabric |
| Amount of absorbed blood under 100 of 0 g/cm <sup>2</sup>   | 18 ml   | 65 ml  |
| Amount of absorbed blood under load of 45 g/cm <sup>2</sup> | 8 ml  | 43 ml  |

As will be apparent from the results obtained in Examples 1 and 2, the absorbent material used in the present invention is much more effective than the conventional material, and also substantially no leakage of the retained liquid is caused even under application of pressure.

Fig. 1 is central sectional view of a nappy according to the invention; and

Fig. 2 is a central sectional view of a feminine sanitary towel according to the invention.

#### Example 3

A nappy having a structure as shown in Fig. 1 was prepared. More specifically, two layers each consisting of three sheets of crepe paper 2, were placed above and below a central layer 3 composed of a mixture of 0.5 g of sodium salt of 30%-

hydrolyzed polyacrylamide and 0.5 g of sodium alginate. The assembly was enclosed on three sides by a vinyl resin sheet 4 and the upper side was sealed with a non-woven fabric 1 to form a nappy.

#### Example 4

A feminine sanitary towel having a structure as shown in Fig. 2 was prepared. More specifically, two layers 3, each being composed of a powder mixture of 0.3 g of ammonium salt of a branched polyacrylic acid and 0.3 g of sodium calcium alginate (the Na:Ca cation ratio being 9:1) were interposed between two sheets of crepe paper 2. The assembly was placed on a vinyl resin sheet 4 and wrapped with a non-woven fabric 1 to form a feminine sanitary towel.

#### Example 5

1 g of a mixture of sodium salt of a partially hydrolyzed starch-acrylamide graft copolymer (hereinafter referred to as "Na-SAA") and guar gum was sealed in a non-woven fabric of a size of 5 cm×10 cm, and this sample was immersed for 10 minutes in simulated urine (containing by weight 2.0% of urea, 1.0% of NaCl, 0.1% of CaCl<sub>2</sub>, 0.1% of MgCl<sub>2</sub> and the balance deionized water). The sample was held in air at room temperature for 30 minutes and the amount of the absorbed liquid was determined. Further, after a load of 45 g/cm<sup>2</sup> was imposed on the sample for 3 minutes, the amount of the absorbed liquid was similarly determined. The results obtained are shown in Table 3.

TABLE 3

| Run No.    | Na-SAA (wt.%)            | Guar Gum (wt.%) | Amount (ml) of Absorbed Liquid under Load of 0 g/cm <sup>2</sup> | Amount (ml) of Absorbed Liquid under Load of 45 g/cm <sup>2</sup> |
|------------|--------------------------|-----------------|--|---|
| 1          | 100                      | 0               | 43   | 22  |
| 2          | 70                       | 30              | 72   | 49  |
| 3          | 50                       | 50              | 78   | 55  |
| 4          | 30                       | 70              | 63   | 41  |
| 5          | 0                        | 100             | 27   | 20  |
| comparison | 10 sheets of crepe paper |                 | 35   | 13  |

#### Example 6

Horse blood was dropped at a rate of 10 ml per minute from a pipette having an orifice diameter of 2 mm onto the central portion of a feminine sanitary towel of the present invention containing 0.5 g of a sodium salt of a branched polyacrylic acid (Na-PPA) and 0.5 g of a guar gum, and also on a conventional feminine sanitary towel having the same weight and form as above but not containing the composition specified in the invention. The amount of the liquid that had been dropped onto the sample was measured when the sample became saturated with the blood. The results obtained are shown in Table 4.

TABLE 4

|   | Conventional Feminine Napkin (6.0 g)   | Feminine Napkin (6.0 g) of Present Invention  |
|---|--|---|
| Materials   | 5.0 g of absorbent paper, 0.5 g of water-proof paper and 0.5 g of non-woven fabric | 4.0 g of absorbent paper, 0.5 g of polybranched Na-PAA, 0.5 g of guar gum, 0.5 g of water-proof paper and 0.5 g of non-woven fabric |
| Amount of absorbed blood under load of 0 g/cm <sup>2</sup>  | 18 ml  | 63 ml   |
| Amount of absorbed blood under load of 45 g/cm <sup>2</sup> | 8 ml   | 48 ml   |

#### Example 7

5 g of a mixture of a sodium salt of a partially hydrolyzed starch-acrylamide graft copolymer (hereinafter referred to as "Na-SAA") and xanthan gum was sealed in a non-woven fabric of a size of 5 cm×10 cm, and the non-woven fabric was immersed

for 10 minutes in 500 ml of a simulated urine (containing by weight 2.0% of urea, 1% of NaCl, 0.1% of CaCl<sub>2</sub> and 0.1% of MgCl<sub>2</sub>, and the balance deionized water). Then, the sample was held in air at room temperature for 30 minutes and the amount of the absorbed liquid was determined. Further, the amount of the absorbed liquid was measured after a load of 45 g/cm<sup>2</sup> had been imposed for 3 minutes. The results obtained are shown in Table 5.

TABLE 5

| Run No.    | Na-SAA (wt. %)           | Xanthan Gum (wt. %) | Amount (ml) of Absorbed Liquid under Load of 0 g/cm <sup>2</sup> | Amount (ml) of Absorbed Liquid under Load of 45 g/cm <sup>2</sup> |
|------------|--------------------------|---------------------|--|---|
| 1          | 100                      | 0                   | 43   | 22  |
| 2          | 70                       | 30                  | 83   | 62  |
| 3          | 50                       | 50                  | 105  | 80  |
| 4          | 30                       | 70                  | 94   | 71  |
| 5          | 0                        | 100                 | 76   | 49  |
| comparison | 10 sheets of crepe paper |                     | 35   | 13  |

## Example 8

Horse blood was dropped at a rate of 10 ml per minute from a pipette having an orifice diameter of 2 mm onto the central portion of a feminine sanitary towel of the present invention comprising a sodium salt of a branched polyacrylic acid (Na-PAA) and a xanthan gum and also onto a conventional feminine sanitary towel having the same weight and form as above but not containing a composition as specified in the invention. The total amount of blood that had been dropped was measured when the sanitary towel became saturated with the blood. The results shown in Table 6 were obtained.

TABLE 6

| Conventional Feminine Napkin (6.0 g)   | Feminine Napkin (6.0 g) of Present Invention   |
|--|--|
| 5.0 g of absorbent paper, 0.5 g of water-proof paper and 0.5 of non-woven fabric | 4.0 g of absorbent paper, 0.5 g of polybranched Na-PAA, 0.5 g of xanthan gum, 0.5 g of water-proof paper and 0.5 g of non-woven fabric |
| Amount of absorbed blood under load of 0 g/cm <sup>2</sup>                       | 18 ml  |
| Amount of absorbed blood under load of 45 g/cm <sup>2</sup>                      | 82 ml  |
|  | 57 ml  |

## WHAT WE CLAIM IS:—

1. A sanitary article for absorbing bodily fluids containing an absorbent composition comprising a mixture of (a) a salt of an acrylic acid polymer, and (b) guar gum, an alginate, xanthan gum or a mixture of two or more thereof.

2. A sanitary article according to Claim 1, wherein the weight ratio of (a): (b) is 5:95 to 95:5.

3. A sanitary article according to Claim 1 or Claim 2, wherein the salt of the acrylic acid polymer is selected from sodium, potassium and ammonium salts of linear polyacrylic acids, branched polyacrylic acids, partially hydrolysed polyacrylamides, partially saponified polyacrylic acid esters, graft copolymers of acrylic acid and cellulose or starch, and mixtures thereof.

4. A sanitary article according to any preceding Claim, in which the alginate is selected from the alkali metal salts and alkaline earth metal salts of alginic acid, and mixtures thereof.

5. A sanitary article according to any of the preceding Claims, in which the weight ratio of a:b is from 30:70 to 70:30.

6. A sanitary article according to any preceding Claim which is a feminine sanitary towel, containing a layer of the absorbent composition.

7. A sanitary article according to any of Claims 1 to 5 which is a disposable nappy containing a layer of the absorbent composition.

8. A sanitary article as claimed in Claim 6, wherein the amount of the absorbent composition is from 0.1 to 5.0 grams.

5 9. A sanitary article as claimed in Claim 7, wherein the amount of the absorbent composition is from 0.1 to 5.0 grams. 5

10. A sanitary article according to Claim 1, substantially as herein described with reference to the Examples.

10 11. A nappy substantially as herein described with reference to Fig. 1 of the accompanying drawings. 10

12. A feminine sanitary towel substantially as herein described, with reference to Fig. 2 of the accompanying drawings.

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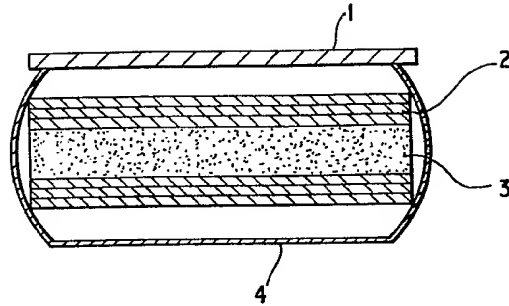


FIG.1.

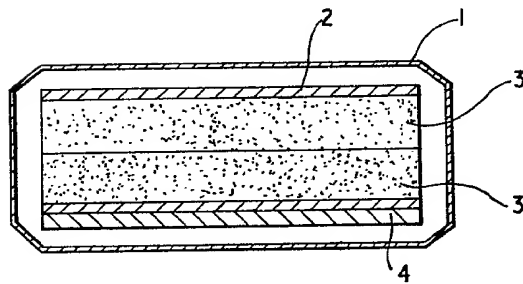


FIG.2.